MACHINE FOR BOXING WOUND COILS OF FILAMENTARY MATERIAL

by

Frank W. Kotzur et al.

BACKGROUND OF THE INVENTION

Field of the Invention:

This invention relates to method and apparatus for winding and boxing wound coils of filamentary material, and more particularly to such method and apparatus for automatically inserting a payout tube into a radial opening in a wound coil of filamentary material, threading an end portion of the filamentary material through the payout tube, inserting the wound coil into a container and securing the end of the withdrawn filamentary material on the container, and closing the flaps of the container, sealing the container and removing the container from the machine.

Related Art:

The following patents each disclose container structure for retaining a wound coil of filamentary material for feedout through a radial opening in the wound coil and out of the container.

U.S. Patent No. 3,677,491 to Gerwig discloses a package for a wind of flexible material and having end-forming flaps hinged about axes perpendicular to the axial opening of the wind. Truncated pyramids project inwardly from the end walls to control the unwinding of the coil and are formed by the folding of a blank of cardboard having extending flaps interleaved with the end flaps of the box to hold the pyramids in position.

U.S. Patent No. 3,748,817 to Newman discloses a package of a compressed wind with the end walls substantially perpendicular to the longitudinal axis of the package.

U.S. Patent No. 3,923,270 to Newman et al. discloses a package provided with tapering members within the axial opening to guide the individual coils of the material as they are withdrawn, in the space between the cone and the inner wall there is arranged a removable solid material which is held against the inside coils of the package.

U.S. Patent No. 3,985,315 discloses a package for containing a wound coil with a funnel having a stem positioned in the radial opening and with the mouth thereof substantially at the midplane of the package.

U.S. Patent No. 4,019,636 to Wise discloses a carton having a series of connected walls forming a perimeter around the coil and each of the walls has opposed hinged flaps. Tabs located on the edge of each flap opposite the hinged connection and the tabs on each side of the coil interlock to form a tapered boss extending into the open center of the coil spaced from, but facing, the like opposing boss.

U.S. Patent No. 4,160,533 to Kotzur et al discloses a container having an octagonal insert and corner payout and includes a feedout tube inserted in the radial hole of the wind. Opposite sides of the insert engage the inner surfaces of the container. The bottom and upper surfaces of the container include intersecting cone sections for supporting the inner windings of the wound filamentary material.

As is evident from a consideration of the above prior art

there is a need for improved method and apparatus for automating the packaging of wound coils.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a method and apparatus for automatically winding and packaging wound coils of filamentary material in a container including a payout tube for paying out the wound coil through a radial opening in the coil and an aligned opening in the container retaining the payout tube.

It is a primary feature and advantage of the present invention that a wound coil of filamentary material may be automatically packaged in a wound coil having a radial opening for receiving a payout tube and through which the wound filamentary material is withdrawn from an aligned opening in the container.

Yet another object of the present invention is to provide method and apparatus for loading a wound coil of filamentary material, having a payout hole extending through the coil from the outermost wind to the innermost wind, from a turret station where the filamentary material is wound, and for positioning the wound coil for movement of the wound coil to a boxing station.

It is a feature and advantage of the present invention that the wound coil with a payout hole is positioned for reception of a payout tube in the payout hole and the free end of the wound coil is secured to be subsequently grasped and pulled through the payout tube to the outside of the wound coil and the container.

It is another object, feature and advantage of the subject invention that, in a method and apparatus for winding and packaging coils of filamentary material, a rotating turret mechanism is employed wherein the coil may be wound and then subsequently the wound coil is rotated into a position where the wound coil is located in a boxing station wherein the flaps of the container are folded around the wound coil and the payout tube is automatically inserted through an opening in the container and into the radial opening such that a free end of the coil is grasped and removed through the payout tube and the opening to the exterior of the container.

It is yet a further object of the present invention to provide both method and apparatus for automatically folding the flaps of a container around the wound coil and applying adhesive thereto to form the container.

It is yet a further feature and advantage of the present invention that the flaps of the container containing the wound coil of filamentary material are automatically glued and folded.

It is still another object of the present invention to provide both method and apparatus for automatically removing the packaged container of wound filamentary material from the packaging apparatus.

It is still another feature and advantage of the present method and apparatus that the container of wound filamentary material is automatically removed from the packaging apparatus.

The boxing machine of the present invention includes a rotating turret station where the coil of filamentary material is wound and then rotated and positioned at a payout tube insertion and boxing station wherein the various flaps of the container are folded around the wound coil. This station includes means for placing a payout tube into position for being inserted through a flap in the container and into the radial opening in the wound coil whereby an exposed end of the wound coil is grasped and removed through the payout tube to the exterior of the container. During this operation another coil is being wound at the opposite side of the turret for subsequent rotation to the payout tube insertion and boxing station. Various sensors provide signals to a programmer for controlling the winding of the coil, the movement of the turret, the operation of the payout tube insertion operation and the gluing and folding of the various flaps of the container to form the box enclosing the wound coil.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects, features and advantages are readily apparent from the following description of a preferred embodiment of the best mode for carrying out the invention when taken in conjunction with the following drawings, wherein:

Fig. 1 shows a perspective view of the major components of the turret, including the coil winding station, and the payout tube insertion and packaging station according to a preferred embodiment of the present invention;

Fig. 2 shows the filamentary material entering the jaws of the opened clamp at the end of the collapsible mandrel as the mandrel and the end form are moved towards the filamentary material;

Fig, 3 shows the filamentary material grasped by the jaws of the clamp which are now closed;

Fig. 4 illustrates the entry of the collapsible mandrel on the opposing mandrel and end form which is being moved into interleaving relationship with the mandrel and end form illustrated in Figs. 5 and 6 and whereby the filamentary material is being pushed toward the latching mechanism on the first mentioned end form, with the collapsible mandrels being further engaged as the second collapsible mandrel is pushed further into engagement with the first mentioned collapsible mandrel and the filamentary material firmly engaged in the latch at the base of the end form and with the collapsible mandrels fully engaged;

Fig. 7 is a perspective view of the payout tube supply source;

Fig. 8 illustrates the insertion payout tube holding structure, including the filamentary grasping component;

Fig. 9 illustrates the payout tube insertion and filamentary material grasping mechanism in relation to the mandrel but absent the wound coil for purposes of clarity;

Fig. 10 illustrates the container magazine storage station of the boxing apparatus of the invention;

Fig. 11 shows the boxing station which receives individual containers and the individual wound coils for boxing and which

includes the necessary movable components to rotate the container flaps and gluing mechanism to enclose the wound coil in a completely formed container;

Fig. 12 shows the wound coil positioned in the partially formed container by rotation of the end form and mandrel on which the filamentary material was wound (not illustrated for clarity);

Fig. 13 shows the top panel of the container containing the payout tube opening being placed over the coil;

Fig. 14 shows the payout tube insertion mechanism being inserted in the payout tube opening in the top panel of the container and into the payout tube of the wound coil of filamentary material; and Fig. 14A is detail view of the payout tube;

Figs. 15 and 16 illustrate the manner in which the end of the wound coil is grasped by the payout tube insertion mechanism and withdrawn from the wound coil and the container (Fig. 18) as the top panel is restrained from movement;

Fig 17 illustrates the complete withdrawal of the payout tube insertion mechanism from the wound coil and the container while grasping the free end of the wound coil;

Fig. 18 illustrates the top closure panel of the container posed to be formed over the top of the container; and

Fig. 19 illustrates a completely sealed container.

DETAILED DESCRIPTION

The boxing machine of the present invention includes a filamentary material winding station 30 in which an end form 32, including a collapsible mandrel 33, is positioned in opposing operating relationship to a second end form 34, including a collapsible mandrel (not shown) is mounted to a rotating turret assembly 36, which also includes a third end form 38 and an associated collapsible mandrel 39. The wound coil 40 is shown having been wound on the collapsible mandrel 33, 35, end from 32, 34 structure by a winding mechanism well known to those skilled in the art. For an example of the coil winding process and machinery see Windings' U.S. Patents 4,741,495, 5,413,264 and 5,678,778.

The turret assembly shown in Fig. 1 is ready to rotate 180 degrees so that the wound coil 40 occupies the position of end form 38 and collapsible mandrel 39 and facing a wound coil loading station (not shown, but described below). In addition to mechanism for rotating the turret, the turret assembly also includes mechanism for controlling the collapsing and opening of the collapsible mandrels and for grasping and securing a free end of the filamentary material for winding a coil. For the purposes of this invention it is understood that all such mechanism is known to those skilled in the winding art.

Once a coil has been wound, the end of the coil is grasped and severed by a mechanism and technique well known to

those skilled in the winding art, and the free end of the coil is moved into the vicinity of the open jaws of a clamping mechanism shown in Fig. 2 and which is located on one end of a collapsible mandrel 44 shown in Fig. 2. As shown in Fig. 3, the free coil end is clamped between the jaws of the clamping mechanism and the filamentary material is pushed toward the end form and a filamentary material grabber mechanism 49 as illustrated in Figs. 5 and 6.

As is more fully described hereinafter, once a wound coil is located at the boxing station and within a partially formed container, a payout tube is inserted through a top panel of the container having an appropriate payout tube hole located therein and into the radial hole formed in the wound coil so that a free end of the filamentary material is withdrawn through the radial hole and the payout tube so that the filamentary material can be unwound from the inside of the coil (The REELEX method, proprietary to Windings and as represented by the above-mentioned patents).

Fig. 7 illustrates the plastic payout tube supply source used in the present invention and which comprises a number of stacked payout tubes 50 positioned on an inclined ramp 52 and retained by a gate mechanism 54 which is appropriately activated to enable a single plastic payout tube to be released to slide downwardly toward a payout tube retainer, whereby each plastic payout tube is held with the flange 56

thereof resting on top of the retainer 54 and the entrance of the plastic payout tube extending downwardly.

Each individual plastic payout tube in retainer 54 is engaged by a payout tube insertion mechanism is located above the payout tube retainer mechanism and is slid into the plastic tube 50 and which includes a movable rod 60 extending below the bottom of the payout tube 50 and immediately adjacent a fixed portion of the payout tube insertion mechanism as illustrated in Fig. 8.

Fig. 9 is an explanatory view of the payout tube insertion mechanism and an expanded mandrel but absent the wound coil to illustrate the manner in which the payout tube insertion mechanism 58 coacts to achieve its purpose of deposition the plastic payout tube and simultaneously therewith is able to engage the free inner end of the wound filamentary material. The insertion of the payout tube insertion device into and through the radial payout hole in the wound coil of filamentary material enables the movable rod 60 to squeeze the coil end such that it may be extracted from the wound coil and through the payout tube, which is now engaged with the radial payout hole of the wound coil.

The unfolded containers are stored in a box magazine such as that illustrated in Fig. 10. The individual boxes are transported from the magazine storage area to the boxing station (described more fully below) via a number of vacuum

suction cups (not illustrated) that engage an individual container and lift it to the boxing station were it is released onto the boxing station in position to be folded and receive the wound coil.

The boxing station 69 is shown in Fig. 11 and includes a floor member 70, a back member 72 and a vertically movable ramp member 74 facing a collapsible mandrel, which in normal operation, would include a wound coil to be boxed. When an unfolded container is placed in the box station by the previously described vacuum cups, a back panel is lifted by engagement with back member 72 so that it assumes a vertical position with a bottom panel of the container resting on floor member 70. Movable front flap 74 serves to fold over the front flap of the container after the wound coil is inserted in the partially assembled container (not shown).

The boxing station 69 shown in Fig. 12 illustrates the wound coil positioned in partially formed container 78 by rotation of the turret 36 and the associated end form and mandrel (Fig. 1, also reference mandrel 76 in Fig. 11) into confronting relationship with the boxing station, and more particularly inclined ramp 74. The mandrel 76 is lowered and the boxing station moved forward so that the wound coil is inserted in the partially formed container as shown in Fig. 12 with side panels 79 and 80 of the container being raised as illustrated. One of the elements for engaging the side panel

80 is shown in the Fig. A corresponding element exists on the opposite side of the container for elevating side panel 79.

In Fig. 13 element 82 closes a top panel 83, including payout tube opening 84 of the container. Back panel 72 is lowered thereby enabling element 85 to engage and support side panel 80. A similar element on the other side of the container supports side panel 79.

Fig. 14 illustrates the payout tube insertion mechanism 90 inserting a payout tube 92 in the payout tube opening 93 in the top panel 83 of the container and the radial opening in the wound coil. A typical plastic payout tube is shown in Fig. 14A.

Figs. 15 and 16 illustrate the manner in which the end of 100 of the wound coil is grasped by fingers 102 of the payout tube and insertion mechanism as it is withdrawn from the top panel 83. As shown in Fig. 16 element 82 prevents top panel 83 from lifting as the payout tube insertion mechanism 90 is raised.

In Fig. 17 the payout tube insertion mechanism has cleared the payout hole in top panel 83 with the end 100 of the wound coil grasped between fingers 102. In Fig. 18 a further top panel is being bent over by element (with the withdrawal of element 82) to secure the payout tube. Subsequently automatically operated gluing mechanisms glue appropriate portions of the side panels and the completed

container is shown in Fig. 19 with end 100 of the wound coil projecting from the container, thereby enabling the filamentary material to be withdrawn through the radial opening and the payout tube.

It is desired that the present invention not be limited to the embodiments specifically described, but that it include all such modifications and variations that would be obvious to those skilled in this art. It is my intention that the scope of my invention should be determined by any and all equivalents of the various terms and structure as recited in the following annexed claims.